

What is claimed is:

1. A ridge waveguide semiconductor laser diode adapted to support desired lateral modes of generated light, comprising:

- a first conductor layer for application of a current;
- a second conductor layer facing the first conductor layer;
- an active layer disposed between the first and second conductor layers;
- a defined gain region of the active layer adapted for conducting the current; and,
- reduced conductivity regions of the active layer, flanking the defined gain region, adapted to impede passage of the current.

2. The semiconductor laser diode according to claim 1, further comprising at least one quantum wells layer formed in the active layer.

3. The semiconductor laser diode according to claim 1, wherein the defined gain region has a lateral extent adapted to support a desired lateral mode of the light.

4. The semiconductor laser diode according to claim 3, wherein the lateral extent supports a fundamental lateral mode.

5. The semiconductor laser diode according to claim 1, wherein the active

layer is formed of at least one of GaAs, InGaAs, AlGaAs, AlInGaAs and InGaAsP.

6. The semiconductor laser diode according to claim 1, wherein the first and second conductor layers are adapted to provide a current through the active layer that is larger than a threshold current of the active layer.

7. The semiconductor laser diode according to claim 1, wherein the defined gain region further comprises a light amplification portion sustaining the desired lateral modes, said light amplification portion having a smaller lateral extent than the defined gain region.

8. The semiconductor laser diode according to claim 1, wherein the reduced conductivity regions are implanted with high energy ions.

9. The semiconductor laser diode according to claim 8, wherein the reduced conductivity regions are implanted with protons of energy between about 130 KeV and 170 KeV.

10. The semiconductor laser diode according to claim 1, wherein the reduced conductivity regions provides a lateral index step.

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11. The semiconductor laser diode according to claim 1, further comprising an insulator layer disposed adjacent the first conductor layer, for insulating a portion of the first conductor layer.
12. A method of forming a semiconductor laser diode providing controlled lateral diffusion of a gain current, comprising:
- forming an active layer, a positive and a negative conductor layer;
 - disposing a barrier layer outside of the active layer, the barrier layer forming a mask defining an opening having a lateral dimension corresponding to a defined gain region; and
 - implanting high energy ions in the formed layers, the barrier layer being between a source of the high energy ions and the active layer during implanting.
13. The method according to claim 12, wherein disposing the barrier layer comprises disposing a photoresist layer.
14. The method according to claim 12, wherein the implanting step includes implanting protons having an energy of between about 130 KeV and 170 KeV.
15. The method according to claim 14, wherein the implanting step comprises implanting the protons for a time period of at least about 1 minute.

16. The method according to claim 15, wherein the implanting step comprises implanting the protons for a time period of about 5 minutes.
17. The method according to claim 12, further comprising selecting the lateral dimension of the opening to support a fundamental lateral mode of the light in the active layer.
18. The method according to claim 12, further comprising disposing said layer on an outer surface of the positive conductor layer.
19. A method of controlling lateral extent of a defined gain region of an active layer in a semiconductor laser diode, comprising:
- forming a positive and a negative conductor layer facing respectively opposite surfaces of the active layer;
 - forming reduced conductivity regions of the active layer flanking the defined gain region of the active layer; and
 - passing a gain current through the defined gain region of the active layer between the positive and negative conductor layers, such that passage of the current outside of the defined gain region is impeded by the reduced conductivity regions.
20. The method according to claim 19, wherein the reduced conductivity

regions are formed by proton implanting.

21. The method according to claim 19, further comprising selecting dimensions of the defined gain region so that a desired mode of light is supported.

22. The method according to claim 21, wherein the desired mode is a fundamental mode of the light.

23. The method according to claim 19, further comprising forming an insulating layer between the active layer and one of the positive and negative conductor layers, said insulating layer having at least one opening corresponding to the defined gain region of the active layer.

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